REPORT

OF THE

CHEMICAL ANALYSER TO GOVERNMENT, BOMBAY,

FOR THE YEAR 1886.

J.J. K-31

Bombay:
PRINTED AT THE GOVERNMENT CENTRAL PRESS.
1887.

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To

THE SECRETARY TO GOVERNMENT,
GENERAL DEPARTMENT,
Bombay.

SIR,

As Chemical Analyser to the Government of Bombay I have the honour to submit the following report for the year 1886, being the Sixteenth Annual Report of this department.

2. The following is a summary of the work done by the department during the year under report :—296 medico-legal cases, involving the separate analysis or examination of 956 different articles, were investigated and reported on. In addition, 112 samples of potable water and 1,015 samples of Government stores and miscellaneous articles were examined or analysed, making a gross total of 2,083 different articles examined or analysed during the year.

3. The table, which follows, shows the number of medico-legal cases, reported on and other analyses effected during each of the last five years :—

Class.	1882-83.	1883.*	1884.	1885.	1886.
Medico-legal cases	260	218	314	336	296
Potable waters	27	61	98	108	112
Government stores	540	681	384	348	444
Customs and abkári analyses			493	576	479
Miscellaneous	47	51	82	88	92
Total ...	874	1,011	1,371	1,456	1,423

*Nine months only.

Section 1.—Medico-Legal.

4. The 296 medico-legal cases, referred to this office during the year 1886 were forwarded from 117 different stations, and may, as usual, be divided into three classes, *viz.* :—(1) cases of real or alleged poisoning of human beings, (2) cases of real or alleged cattle-poisoning, and (3) other cases, chiefly cases involving the examination of articles suspected to be stained with blood or other animal fluids. Of the 296 medico-legal cases referred to this office during the year under report, 159 belong to the first, 83 to the second, and 54 to the third of these classes. The table below gives corresponding figures for the past five years :—

Class.	1882-83.	1883.*	1884.	1885.	1886.
Suspected human poisoning	159	138	169	187	159
Do. cattle-poisoning	70	45	103	101	83
Blood stains, &c.	31	35	42	48	54
Total ...	260	218	314	336	296

*Nine months only.

5. *Cases of Suspected Human Poisoning.*—Of the 159 cases of this class referred for examination and report during the past year, some poison or other was detected in 89, or nearly 56 per cent. This is slightly over the usual percentage of detections. Probably the increased proportion of detections is, in part at least, due to a better selection of the cases forwarded.

6. The table, which now follows, shows the general nature of the poison found in each of the 89 cases of alleged human poisoning, in which poison was detected during the year, the cases being distributed according to the districts from which they were forwarded :—

Districts.	Arsenic.	Pounded Glass.	Other Mineral Poisons.	Opium.	Dhatura.	Other Organic Poisons.	Total.
Ahmedabad	2	...	...	1	1	...	4
Ahmednagar	1	1	...	1	...	...	3
Belgaum	2	...	1	...	...	...	3
Bijápur	2	...	1	...	...	...	3
Bombay	1	...	1	...	...	1	3
Broach	1	...	...	...	1	...	2
Dhárwár	2	...	1	...	...	...	3
Kaira	3	...	1	5	2	...	11
Kaládgi	1	...	1	...	...	...	2
Kolába	...	1	...	...	...	1	2
Khándesh	3	1	...	...	...	1	5
Násik	1	...	1	...	...	...	2
Poona	1	...	1	1	...	2	5
Ratnágiri...	...	...	...	...	...	1	1
Sátára	5	...	2	1	...	...	8
Sholápur	1	...	...	1	...	...	2
Surat	...	...	2	1	...	1	4
Thána	4	1	2	...	...	...	7
Sind	6	...	...	...	...	...	6
Mhow and other cantonments ..	3	...	...	...	...	...	3
Total ...	39	4	14	11	4	7	79
Native States	...	...	...	1	...	...	1
Central Provinces and Berárs	8	...	...	...	...	1	9
Grand Total ...	47	4	14	12	4	8	89

7. So far as can be made out from the reports furnished to this office, the 89 cases of alleged human poisoning, in which poison was detected during the past year, included the poisoning of 128 persons, of whom 50 died. As will be seen from the table which follows, these numbers are all greater than those of 1884 and previous years, but smaller than those of 1885. The smaller numbers of 1886, as compared with 1885, are principally due to the fact that while in 1885

18 fatal cases of opium poisoning were reported to this office, in 1886 the number of similar cases was only 11:—

	1882-83.	1883.*	1884.	1885.	1886.
A.—Cases—					
Arsenic	41	31	47	51	47
Opium	2	17	9	20	12
Dhatura...	4	5	4	5	4
Other poisons	24	18	23	26	26
Total Cases ...	71	71	83	102	89
B.—Persons poisoned—					
Arsenic	57	29	50	91	88
Opium	2	17	9	18	11
Dhatura...	4	33	10	17	13
Other poisons	11	6	29	27	16
Total Persons poisoned ...	74	85	98	153	128
C.—Deaths—					
Arsenic	28	18	22	32	31
Opium	1	15	9	18	11
Dhatura...	...	4	1	...	...
Other poisons	7	2	3	14	8
Total Deaths ...	36	39	35	64	50

*Nine months only.

8. Below is a more detailed statement, showing the poison found in each of the 89 cases referred to:—

Poisons.	Cases.
Arsenious oxide	42
Sulphides of arsenic...	3
Arsenite of copper	2
Pounded glass	4
Red lead	1
Chlorides of mercury	2
Sulphide of mercury	2
Copper	9
Opium	12
Dhatura	4
Alcohol	1
Chloral	1
Oxalic acid	1
Oleander	2
Marking nut	1
Gloriosa superba	1
Urginea indica	1
	89

and the following is a summary of the cases on which these poisons were detected:—

9. *Arsenic.*—As shown in the table following paragraph 7, the 47 cases in which arsenic was detected during 1886, included the poisoning of 88 persons, of whom 31, or 35·2 per cent., died. This is almost exactly the same percentage of deaths to persons poisoned as was recorded in 1885. It is, however, a much lower percentage of mortality from arsenic poisoning than that of 1884, and previous years. The table following paragraph 6 shows the districts from which

each of the 48 cases in which arsenic was detected, was forwarded. The deaths were distributed as follows:—Berárs, 8; Sind, 6; Khándesh, 4; Thána, 3; Kaira and Satára, 2 each; Cantonments (Asirgarh and Hingoli), 2; and Ahmedabad, Dhárwár, Poona, and Sholápur, 1 each.

10. Of the 42 cases in which arsenious oxide was detected during the year, 13 were cases of multiple poisoning, in which altogether 59 persons, of whom 10 died, were poisoned. In every one of these 13 cases the poison seems to have been mixed with some sort of food afterwards eaten by the sufferers. In one case the precise nature of the article of food used as a vehicle for the poison was not stated. In 5 cases sweetmeat, in 5 others bread or flour, in one case milk and flour, and in another dáll or pulse, formed the vehicle of administration. Of the 10 individuals that died, 3 were children. Taking, first, the cases in which children were killed, these were—(1) a case from Ghotki (Sind District), in which 8 grains of arsenious oxide was detected in the viscera of a boy, and 10 grains in the viscera of an adult male, both of whom died after eating sweetmeat; also partaken of by one other adult and 3 other children, who recovered. (2) A similar case from Bhusával (Khándesh District), in which a man and a boy died after eating sweetmeat. The child died on the third day, and the man almost immediately. In this case altogether 5 persons were poisoned. A portion of the sweetmeat forwarded for examination was found to contain arsenious oxide (3) A case from Shikárpur (Sind District), in which a child and a man suffered from symptoms of arsenical poisoning after eating jowári bread prepared by a woman. Half an hour after eating the bread, both began to vomit and purge, and complained of a tingling and burning sensation in the throat, the man also stating that the whole of his inside was burning. The man recovered, but the boy died 25 hours after taking the food. Every one in the village tried to conceal the facts of the case. The woman who cooked the bread, on pressure, admitted that she had reduced to powder a white substance, and mixed it therewith. The body of the boy was exhumed nine days after burial, and at the *post-mortem* examination the mucous membrane of the stomach was found congested and covered by a layer of yellow mucus, with a white-looking substance adhering to it. The small and large intestines were also found congested. On analysis, arsenic was discovered in the stomach and intestines. A trace was also separated from the liver by the "chloride distillation process." These 3 cases, therefore, account for 5 deaths, *viz.*, 3 children and 2 adults. The remaining cases of multiple poisoning accompanied by fatal results were as follows:—(4) A case from Phaltan (Satára District), in which a man died on the sixth day after eating jowári bread containing arsenious oxide. In this case, 8 persons altogether were attacked by the usual symptoms of irritant poisoning, and all on the following day had apparently recovered. Four days afterwards, however, deceased had a relapse, and sank under it. (5) A case from Dákor (Kaira District), in which a man and a woman were poisoned by arsenious oxide given to them in bread by another man. The male sufferer, who was an opium-eater—consuming, it is said, one tolá of opium per diem—died on the following day, but the woman recovered. (6) A case from Thána, in which 4 persons, of whom one—a man—died, were attacked by symptoms of arsenical poisoning after eating sweetmeat given to them by another man in their company. The local "Panch" pronounced an opinion that the man died of choleraic diarrhœa, as the other 3 persons poisoned were attacked similarly at intervals, but recovered. In the stomach, however, of the deceased more than 30 grains of arsenious oxide were found. (7) A case from Karáchi, in which 2 women and 2 children were poisoned by arsenious oxide in sweetmeat. Both women died, but the children got well. One of the women had so far recovered that she left hospital the day after she was admitted, but returned the day following, suffering from a relapse, to which she succumbed with marked symptoms of irritant poisoning. No death was recorded in the remaining 6 cases of multiple poisoning. These were:—(8) A case from Sátára, in which 5 persons, members of one family, were attacked with vomiting and purging after eating food containing arsenious oxide. (9) A case from Ahmednagar, in which arsenious oxide was detected in flour found in the possession of a woman accused of poisoning certain persons, number not stated, who vomited after eating food given to them by the accused. (10) A case from Mahábaleshvar, in which 5 persons were poisoned by arsenious oxide. In this case the poison

was detected in some sugar, and also in matters vomited by the affected persons. (11) A case from Broach, in which 3 persons were poisoned by arsenic given to them in cooked milk and rice. (12) A case from Indi (Káladgi District), in which 5 members of a family were poisoned by eating jowári bread and dáll, the latter containing a large quantity of arsenious oxide. And, last, (13) a case from Islámpur (Sátára District), in which 6 members of a family after eating bread and vegetables were attacked with symptoms of arsenical poisoning. The matter vomited was eaten by 3 fowls. These died soon after. On analysis, arsenious oxide was found in the viscera of the fowls, and also in the remainder of the bread and vegetables eaten by the sufferers,

11. 19 more of the cases in which arsenious oxide was detected, were fatal cases in which one individual only was poisoned. In 6 of these cases, from respectively Murtizápur, Amráoti, Bársi, Buldána, Asirgarh, and Sholápur, the deceased individuals were male adults, but whether they were cases of suicide or homicide cannot be made out from the reports furnished. In the Murtizápur case it is worthy of remark that no less than 360 grains of arsenious oxide were found in the stomach of the deceased. In 3 more cases, from respectively Nandurbár, Modása, and Bassein, without history, the deceased persons were female adults; while in one case, from Secunderabad, " a person" died, but whether the person was a male or female was not stated. Of the remaining 9 cases, in 3 the victims were adults and in 6 children. Of the adult cases, one from Amráoti (female) and one from Bhusával (male) were reported to be cases of homicide. In the former case the mother of the deceased was suspected to be the guilty person, and was reported to have decamped; in the latter, the husband seems to have been poisoned by bread prepared by his wife when they were on a visit to her father's house. In this case, the victim died with marked symptoms of irritant poisoning, and at the *post-mortem* examination all the organs were found healthy, with the exception of the stomach, the mucous membrane of which was congested and ecchymosed in places with white gritty particles of arsenious oxide adherent to it. One case, from Uran (Thána District), was reported to be a case of suicide of an adult female with the following history. Deceased having some dispute with her father, who struck her, soon afterwards swallowed something, and was seized with symptoms of irritant poisoning, dying 52 hours afterwards. The 6 cases in which children were killed, were (1) a case from Akola, reported to be a case of homicide, the victim being a boy three and a half years old. Death occurred 17 hours after administration of the poison in sweetmeat. The accused in this case admitted having given the deceased some sweetmeat, and was proved to have, a short time previously, purchased white arsenic. (2) A case from Hingoli, in which a boy aged eight was poisoned, but no details were furnished. (3) A case from Wái, in which a child, one year and three months old, died with the usual symptoms of irritant poisoning within four hours after having been given arsenious oxide in food. (4) A case from Chándor, without history, in which arsenious oxide was found in large quantity in the viscera of a child aged seven years. (5) A case from Hyderabad (Sind District), in which a boy about three years old died within two and a half hours after eating some sweetmeat, which, it was alleged, was given him by another boy eight years of age. Symptoms of irritant poisoning appeared within four minutes after swallowing the sweetmeat. At the *post-mortem* examination the stomach and intestines were found highly congested, and the stomach had, adhering to its inner surface, white particles weighing one grain, which on examination proved to be arsenious oxide. Lastly, in a sixth case, from Nadiád, arsenious oxide was found in the viscera of a boy aged eight years. The father of the deceased stated that poison was given to the child in some sweetmeat by one of his caste-fellows, and that vomiting and purging set in about half an hour after. He first attributed these symptoms to cholera; but as some bad feeling existed between himself and his caste-fellows, he afterwards suspected that the boy had been poisoned. In this case, also, minute particles of arsenic were found adherent to the mucous membrane of the stomach.

12. The remaining 10 cases, in which arsenious oxide was detected during the past year, were all non-fatal cases, in which only one individual was poisoned. Of the 10, one, from Bassein, was a case in which arsenic was mixed in flour, made into bread by an 'individual', with a view to giving it to

'another individual' as food. While chewing the bread this person felt some gritty particles between his teeth, and handed over the bread to the Police. When examined, the bread was found to contain (1) arsenious oxide, and (2) a small quantity of coarsely powdered pale-green glass. In another case from Wái (Sátára District), without history, arsenious oxide was detected in a mixture of bread and vegetables. A third case, from Bijápur, was one in which 25 per cent. of arsenious oxide was found in two masses of dirty-green paste; these, with other substances found to be non-poisonous, were given by one man to another, with instructions to mix them with the food of the police pátil of Khánápur village. The man, instead of acting as instructed, handed over the substances to the pátil himself, informing him at the same time how he became possessed of the articles. In a fourth case, from Bombay, a woman, it was alleged, attempted to murder a man. 5 grains of arsenious oxide was found in the contents of a spitoon and 6 grains in the contents of a wine glass. 3 powders were also examined in this case: 2 were composed of carbonate of lead, and 1 was a mixture of oxide and carbonate of zinc. The accused was tried at the Criminal Sessions of the High Court, Bombay, but acquitted. In a fifth case, from Kaira, arsenic was detected in some powders. In a sixth case, from Yeola (Násik District), arsenic was contained in some powder and in bread, but no history of the case was forwarded. The seventh case, from Hyderabad (Sind), was one in which arsenious oxide was detected in two bottles of vomited matter. A man in this case did not get on with his wife, who, it is said, had been carrying on an intrigue with another man, and hence attempted to get rid of her husband. The usual symptoms of irritant poisoning were present along with occasional cramps. The eighth case, from Dhárwár, was one in which a jail prisoner, after eating some bread, complained of a bitter taste in his mouth, and within half an hour after was suffering from severe pain in the stomach. The matters vomited contained 8 grains of arsenious oxide, and the bread also was found to contain a large quantity of the poison. In the ninth case, from Dholka (Ahmedabad District), more than 30 grains of arsenious oxide was separated from the vomit of a man who had the usual symptoms of arsenical poisoning. In the tenth and last case, from Belgaum, a man, after eating a small quantity of some food given him by his wife, complained of an unusual taste in his mouth. On analysis, arsenic was found in large quantity in the food in question and also in matters vomited by the man. From the above it will be seen that 5 of the 10 cases under notice appear to have been attempts at homicide.

13. In 5 cases an arsenical compound other than arsenious oxide was detected, *viz.*, (1) in a case from Dhárwár, arsenite of copper was found in some cooked rice, a portion of which, it was stated, had been eaten by a man who thereafter was attacked with the usual symptoms of irritant poisoning. On the following day the poisoned individual was admitted into hospital, where he shortly afterwards died. On admission he was almost pulseless, his body was covered with a cold clammy perspiration, his face livid, his pupils contracted, and his respirations slow and stertorous. He had, in fact, all the symptoms of one suffering from narcotic poisoning. On analysis in this case, arsenic was found in small quantity in the liver, but none could be detected in the stomach and stomach contents. (2) In a case from Ghotki (Sind), in which some masses of yellow substance sent for examination proved to be orpiment or yellow sulphide of arsenic. With this substance a man and a woman appear to have been poisoned. (3) In a case from Poona, in which yellow sulphide of arsenic was detected in a yellow stain on the upper stone of a hand grinding mill. (4) In a case from Belgaum, in which arsenite of copper was found in food, apparently cooked rice, and arsenious oxide in vomited matter. The complainant while eating food prepared by his wife, whom he suspected of trying to poison him, found it to be bitter in taste, and vomited twice. (5) Lastly, in a case from Bijápur, two masses of yellow matter were found, on analysis, to be yellow sulphide of arsenic. Along with these two masses was sent a paste said to be mixed with ghee and made up by a woman for the purpose of rubbing into the head of a man with a view to cause his death. In the paste, however, no poison could be detected.

14. *Pounded Glass.*—This was detected in 4 cases during the year, *viz.*, (1) In a case from Mahád (Kolába District), in which a quantity of fragments of

glass, apparently portions of bangles, were found in some cooked rice. No history of the case was forwarded, but an opinion was asked as to whether "glass powder" would prove fatal "if taken in." To this question the answer given was that "glass powder" when swallowed did very often prove fatal. It is only, however, in large sharp fragments that glass or other similar hard substances could exert the power of intestinal mechanical irritants. Finely powdered glass (glass dust) seems to be innocuous. (2) In a case from Ahmednagar, in which a man partook of some bread prepared and given to him by his wife. For two days he complained of burning pain in the stomach. This pain increased during the third day, and constipation set in. He continued to suffer great pain, and died that evening. During his illness he neither vomited nor purged. Fragments of pale-green glass were found in the bread he had eaten. These were sharp and angular, and might easily have given rise to inflammation in the stomach and intestines. (3) In a case, without history, from Dhulia, in which particles of blue glass were detected in the matter vomited by a man. (4) Lastly, in a case from Panvel (Thána District), powdered blue glass, in large quantity, was found in bread. The particles of glass in the bread corresponded in colour with portions of a glass bangle sent along with the bread. In this case a man charged his wife with an attempt to poison him.

15. *Copper.*—This was detected in 9 cases, *viz.*:—(1) In a case from Háveri (Dhárwár District), in which copper was detected in small quantity in a powder found in the possession of a man reputed to be a sorcerer, and who it was stated had been employed by another man to "place some charms" on the complainant, a police pátil. (2) In a case from Nadiád (Kaira District), in which a compound of copper and zinc (brass) in minute division along with common salt was detected in a packet of powder forwarded along with the viscera of a man who died with symptoms of narcotic poisoning while under treatment by a quack for pneumonia. The powder was given as a medicine, but no poison was discovered in the viscera. (3) In a case from Bassein, in which some minute crystals said to have been found adhering to pieces of bread, proved, on examination, to be sulphate of copper. No trace of the copper salt could, however, be detected in the bread. (4) In a case from Pimpalgaon (Násik District), in which sulphate of copper was found in a mass of cooked vegetables. (5) In a case from Thána, in which sulphate of copper was detected in cooked rice. (6) In a case from Sátára, in which a bluish powder was found to contain sulphate of copper and sand. (7) In a case from Poona, in which one woman gave another some food to eat, the peculiar colour of which aroused suspicion. Four articles of food were sent for examination, and in 2 sulphide of copper was found. Some blue crystals, also sent in this case, turned out to be sulphate of copper. (8) In another case, from Sátára, in which bread and flour were found to contain sulphate of copper in small quantity. (9) In a case from Bombay, in which sulphate of copper and other articles were found in the possession of a person accused of procuring abortion.

16. *Mercury and Lead.*—In 4 cases a compound of mercury was found, *viz*:—(1) In a case from Bijápur in which a mass of mineral weighing 113 grains was identified as mercuric sulphide; (2) in a case from Bágevádi (Bijápur District), in which a man charged his wife, who had been carrying an an intrigue with another man, with an attempt to poison him. A small quantity of brown powder, containing sulphide of mercury and vegetable matter, was found in accused's choli. This powder it was stated had been given to her by her paramour. Packets found in the house of the accused, and containing carbonate of lime and alum, were also forwarded in this case. (3) In a case from Surat, in which impure mercurous chloride (ruskapura) was detected in some yellow fatty paste found in the house of a woman, who died soon after being confined of an illegitimate child said to have been still-born. In this case, packets containing marking nuts *(semecarpus anacardium)*, ferric oxide, and zinc oxide, were also found in the house of the accused. (4) In a case from Navsári (Surat District), in which ruskapura was found in one of several powders sent for examination. In this case, 9 substances, found in the house of a Mahomedan suspected of having mixed poison with drinking water in a masjid, were examined. Several persons after drinking

the water were seized with symptoms of irritant poisoning. The only case in which a compound of lead was found, was a case from Athni (Belgaum District), in which red lead formed the contents of one of three packets found in the house of a woman who died from an attempt to cause her own miscarriage.

17. *Opium.*—Of the 12 cases in which opium was detected during the year, in 10 the drug was found in the viscera of deceased individuals, 5 of whom were male adults, 4 female adults, and 1 a girl aged 13 years. 3 of the 4 adult female cases and the case of the girl just mentioned, were reported to be cases of suicide. 2 of the 5 male cases were also stated to be suicidal. In the other cases no history was forwarded. Of the 10 cases, in which opium was detected in viscera, the following may be specially mentioned: (1) A case from Jetpur (Káthiáwár), in which about 20 grains of opium was found in the stomach of a woman, who was reported to have been poisoned by opium given to her by her paramour before or after cutting off the tip of her nose. She was found in the verandah of her father's house insensible, with her nose cut off and breathing stertorously; she had all the other symptoms of narcotic poisoning. (2) A case from Surat, in which a police constable, after being severely reprimanded for neglect of duty by his superior, committed suicide by swallowing 3 tolás of opium. None of the other 10 cases afford any feature of medico-legal interest. The 2 cases, in which opium was detected in substances other than viscera, were: (1) a case from Parántij (Ahmedabad District), in which opium was detected in a black mass, weighing five and a half grains, taken from the mouth of a dead child 2 months old, and also in stains of saliva on the child's clothes. This was reported to be a case of homicide by a cooly woman, between whom and the parents of the child some bad feeling existed; and (2) a case from Kaira, in which one large and two small dark masses were found to be impure opium containing, approximately, 75 per cent. of impurities. These masses were forwarded, it was stated, "in a criminal case;" no other information as to the nature of the case was, however, supplied.

18. *Dhatura.*—The following is a summary of the 4 cases—all non-fatal—in which this poison was detected during the past year:—(1) In a case from Broach, in which 2 persons were poisoned, some seeds sent for examination were identified as dhatura seeds. (2) In a case from Dholka (Ahmedabad District), 5 persons, after eating food, suffered from symptoms of dhatura poisoning; this food was found, on examination, to contain the alkaloid *daturia;* fragments of dhatura seeds were also detected in a packet of powder forwarded in this case. The affected persons were treated by a Native practitioner, who administered ghee and snuff as an emetic. (3) a case from Kaira, in which 6 persons—one a child—were poisoned; in this case dhatura seeds were detected in the vomited matter and also in some bread cakes. The symptoms present in the individuals affected were reported to be loss of consciousness, dilatation of the pupils, picking at the bed clothes, and attempts to grasp imaginary objects; from the movements of their hands they appeared to be drawing out threads from the tips of their fingers. Their speech was indistinct and incoherent; 2 of the persons became violent, and were put under restraint. (4) Lastly, in another case from Kaira, dhatura seeds and also the alkaloid *daturia* were detected in two packets of bájri bread cake. No particulars of the case were sent.

19. *Alcohol.*—One death from alcoholic poisoning was brought to the notice of this office during the year. In this case (from Amráoti) a man after a drinking bout was found lying dead in the road. His sudden death gave rise to suspicion that he had been poisoned. No poison other than alcohol could, however, be detected in the viscera.

20. *Other Poisons.*—2 cases of poisoning by oleander, both suicidal and both in male adults, were reported during the year. One of the 2 sent from Pen (Kolába District) terminated fatally; the other, from Junnar (Poona District), was a non-fatal case. In both, roots forwarded for examination, and stated to be portions of the poison employed, were identified as oleander *(nerium odorum)* roots. In one case (from Bombay City) the juice of the marking nut *(semecarpus anacardium)* was detected in some stains on a piece of cloth, on which had fallen a portion of a fluid. This fluid, it was stated, had been thrown by a man over his wife's face giving rise to severe burns. In this

case, matters extracted by ether from the stained cloth were found to possess the following characters: (1) An alcoholic solution of the extracted matter treated with caustic potash solution developed a bright green colour soon changing to reddish brown, and (2) a portion of the extracted matter diluted with oil and applied to the skin caused marked irritation. It should be noted that no effect was produced on the skin for the first 48 hours; after this period had elapsed, however, a painful and very persistent eruption appeared. In one case from Ratnágiri, *chloral* was found in the contents of the stomach of a European, who died suddenly after taking a dose of this drug. In a case from Poona, *oxalic acid* was detected in the stomach and intestines of a student of the College of Science, Poona, who is reported to have died suddenly after having taken what was thought to be a dose of sulphate of magnesia. At the *post-mortem* examination there was intense congestion and softening of the walls of the stomach, which contained a dark coffee ground substance, composed of blood and mucus. There was also congestion of the whole of the duodenum, and a similar condition of the right lobe of the liver in contact with the stomach. It may be mentioned that the crystals of oxalic acid are flattened four-sided prisms, with dihedral or tetrahedral summits. They greatly resemble the crystals of sulphate of magnesia and sulphate of zinc, and are sometimes taken in mistake for them. When looked at closely, however, they are easily distinguishable. In a case from Surat, in which a woman was suspected of an attempt to poison her husband, by giving him portions of the nagli plant *(gloriosa superba)* in his food, the plant *(gloriosa superba)* was identified. Lastly, in a case from Bhadgaon (Khándesh District), a portion of the bulb of *urgineæ indica* was identified. In this case, a man (a police patil) was poisoned, but the particulars of the case were not forwarded.

21. Of the cases in which no poison was detected, 42, equal to 26·2 per cent. of the whole number of cases of suspected human poisoning, were cases in which the matters forwarded for examination consisted of the viscera of persons deceased. The corresponding percentages for 1884 and 1885 were 31·3 and nearly 30 respectively. As usual, these 42 cases may be divided into 3 classes, *viz.*, first, cases in which, from the reports forwarded, the balance of evidence appears to be distinctly in favour of death being due to injury or disease; second, cases in which, while there is nothing to show that death was due to disease or injury, there is, at the same time, nothing to show that poison was the cause of death; and, third, cases to which a certain amount of suspicion attaches. Of the 42 cases, 13 belong to the first, 14 to the second, and 15 to the third class. Of the 13 cases of the first class, 7 were cases in which death appears to have been due to disease, *viz.*, heart disease (2), lung disease (2), liver disease (1), ovarian disease (1), and infantile convulsions (1). In one case from Nasirabad, death occurred after abortion. At the *post-mortem* examination, signs of recent delivery were found, and it was suspected, but on what ground was not stated, that the abortion had been caused by the administration of drugs. As no signs of irritation of the alimentary canal were reported, this probably was not the case. In 3 cases, death appears to have occurred from external violence, and in the remaining 2 cases, death seems to have been due to snake-bite.

22. Of the 14 cases of the second class, in 12 the fact, that death occurred suddenly, appears to have been the chief, or only, ground of suspicion. In one case from Chikodi (Belgaum District), death was, from the report forwarded, probably due to alcoholic poisoning; and in another, from Poona, *post-mortem* examination showed the deceased—a female—to be five months gone in pregnancy. This seems to have led to suspicion that death was the result of an attempt to procure abortion. There was nothing, however, in the *post-mortem* appearances to indicate that any such attempt had been made. Of the 15 cases of the third class, in 3 no information was forwarded beyond a statement to the effect that death was supposed to be due to poison. In 6 the history, &c., of the case was such as to raise a suspicion that some irritant poison had been administered, and, in the remaining 6, the history, &c., to a certain extent pointed to narcotic or narcotico-irritant poisoning. Of the first mentioned group of 6 cases, in 2, although irritant symptoms were present during life, no appearances indicative of irritant poisoning were to be found after death. In 2 others, the case was reversed, *post-mortem* appearances of irritant poisoning be-

ing present, but during life there was neither vomiting nor purging. In the remaining 2 both the symptoms and *post-mortem* appearances pointed to irritant poisoning. Of the second group of 6 cases, in 3 poisoning by aconite was suspected: one was a case probably of alcoholic poisoning, in another the symptoms to a certain extent indicated poisoning by oleander, and the sixth was probably a case of kodra poisoning.

23. The 28 cases in which matters other than viscera were forwarded for examination, and in which no poison could be detected, may be classified as follows:—6 were cases in which substances (mostly powders) were erroneously suspected to be poisonous; in one case, sulphur was found; in another, sulphate of lime, ink powder, and tannic acid were detected; in a third case, the powder forwarded proved to be alum; in a fourth, chloride of potassium; in a fifth, sulphate of lime; and in the sixth case, sulphate of iron. 2 were cases in which non-poisonous substances were found in food and vomit. In one of these, from Gokák (Belgaum District), metallic mercury was found in a large quantity in some cooked rice, and in the other, chloride of iron was detected in vomited matter. In a case from Belgaum, seeds, which a milk-woman wished to give to one of the cook boys of the Battery of Artillery stationed there to place in some milk tendered for sale by another milk-woman, were founded to be the seeds of *bixa orellana*, (vern.=sendri, or kesri). The pulp surrounding the seeds is the well-known colouring matter annatto, and is astringent and slightly purgative. Of the remaining 19, 8 were cases in which vomited matters alleged to contain poison were, on analysis, found to be free from the presence of any poisonous substance. In 3 of these, poisoning by dhatura and in 1 poisoning by opium was suspected. In 5 more cases, articles of food were forwarded for analysis, mostly on trifling grounds. In 2 cases substances said to have caused abortion, and in one case the stools of a person said to have been poisoned by dhatura, were examined. In another case a small packet of tobacco was received; the complainant stated that another man gave him a pipe to smoke containing this tobacco mixed with some other drug "by which he lost the power of his sexual organ." When this man was medically examined he was found to be suffering from general debility, probably due to sexual excess. The other 2 cases present no points of interest.

24. *Cases of real or alleged Cattle-poisoning.*—83 cases of this class were submitted for examination and report during the year, and in 45 of these poison was detected. So far as can be ascertained from the reports furnished, the 45 cases, in which poison was detected, included the poisoning of 55 animals, 53 of these being horned cattle, 1 a horse, and 1 a dog. How these figures compare with those of previous years, will be seen from the table below:—

Year.	1880-81.	1881-82.	1882-83.	1883.*	1884.	8 85.	1886.
Number of cases referred ...	86	62	70	45	103	101	83
Number of detections ...	49	39	37	29	58	54	45
Animals killed—							
Ahmednagar	1	1	14	7	8	13	6
Belgaum	2	...	...	...	...	6	3
Kaládgi and Bijápur ...	4	2	...	3	2	3	4
Khándesh	1	2	3	...	5	3	3
Násik	8	9	10	5	7	3	5
Poona	8	6	8	5	7	9	6
Sátára	...	1	1	9	12	8	4
Sholápur	3	4	4	2	1	6	13
Surat	5	...	...	1	3	6	2
Other districts	8	9	13	8	6	3	9
Total Animals killed ...	40	34	53	40	51	60	55

* Nine months only.

25. 10 of the 45 cases in which poison was detected, were cases in which more than one animal was killed. 5 of these cases came from the Sholápur District, 2 from Násik District, and 1 each from Kolába, Poona, and Sátára Districts. Of the 45, in 30 arsenious oxide was the only poison discovered, one of these, from Hingoli (Hyderabad Deccan), being the case of horse-poisoning mentioned above. In 4 more cases, arsenious oxide associated with other substances was found, *viz.*, in 2 cases mixed with red lead, in a third with sulphate of copper, and in a fourth with Scheele's green (arsenite of copper). In 9 cases the seeds of *cerbera thevetia* (yellow oleander) formed the poison used, or attemped to be used. These 9 cases came from the following districts:—Sholápur 4, Sátára 3, and 1 each from Ahmednagar and Belgaum. In one case a substance alleged to have been used as a cattle-poison proved on examination to consist entirely of sulphate of copper; and in one case, from Jalgaon (Khándesh), strychnia was detected in the viscera of a dog.

26. *Cases in which articles suspected to be stained with blood or other animal fluids were forwarded for examination:*—54 cases of this class were referred for report during the past year, involving the examination of 138 different articles. In one of these cases from Indi (Kaládgi District) in certain stains on the sári of a girl aged 14, spermatozoa were detected. The girl had been murdered, presumably after having been raped, and then thrown into a ditch. Blood was also found in other stains on the sári. In 24 cases, blood was found on articles of clothing only, and in 9 on matters other than articles of clothing. The blood-stained articles in these last 9 cases included 3 reaping hooks, 2 knives, and 1 hand-grinding mill, and in 3 cases blood was found on earth and stones. Of the 33 cases in which blood was detected on the articles forwarded, 21 appear to have been cases of murder or assault, 11 were cases of alleged rape, and 1 was a case of alleged causing of abortion, in which, according to the report, a woman "was pregnant two or three months by adultery, and made miscarriage." In several cases the question was asked—Is the stain caused by menstrual or other blood? Although fresh menstrual fluid may, generally, be readily distinguished from recent blood, it is very difficult to give a definite opinion as to whether a stain which is several days old has been caused by the one or the other, especially if the stains are on soiled articles of clothing containing in their meshes abundance of epithelium and other organic debris. Casper, in stating "that there is no distinguishable difference between the two kinds of blood," seems to refer to this class of cases.

Section II.—Potable Waters.

27. Altogether 112 samples of water were examined, as to suitablity for potable purposes, during the year. Of these 53 were classed as good. Of the samples 84 were sent solely for examination as to their potable quality, and 28 were sent by various railway companies and others to be examined both as to their potable quality and as to their fitness for other purposes. The table following this section is a summary of the results obtained so far as they bear on the question of the potability or otherwise of the 112 samples.

28. Referring to the table, analyses Nos. 1 to 9, inclusive, show the results obtained from 9 samples of water forwarded from Aden through the Commissary General, Bombay, the first 8 being from wells in the Kusaf Valley and the ninth from a well in the compound of the Government bakery. All these samples contained a larger amount of dissolved saline matter than is allowable in a good potable water. Samples 4 to 9 contain also chlorides in large quantity; and No. 2, besides yielding a suspiciously high free ammonia result, was found to contain coloured cotton fibres and animal debris.

29. Analysis No. 10 represents the results obtained from a sample of well water from Ahmedabad; these show the water to be of good quality. Analysis No. 11 gives the results obtained from a sample of water from a well at the Annigeri Station, on the Dhárwár-Gadag section of the Southern Marátha Railway. This sample also proved to be of good potable quality, yielding comparatively low results. Nos. 12, 13 and 14 were forwarded by the Garrison Surgeon, Asirgarh, at the request of the Commandant, Fortress Asirgarh. Nos. 12 and 14

were stated to be samples drawn from the Sukkur well, and No. 13 was described as from a "well recently cleaned." No. 12 yielded a higher figure for albumenoid ammonia than is admissible in a good potable water. Nos. 13 and 14 were classed as good, the latter yielding very low ammonia results. Apparently, all 3 samples were taken from the same source—the Sukkur well, but at different times, *viz.*, No. 12 in May before the well was cleaned out, No. 13 in July just after the well had been cleaned, and No. 14 in August some time afterwards.

30. Samples 15, 16 and 17 were forwarded by the Executive Engineer, West Berár Division, Akola; all 3 yielded low ammonia results, but No. 16 contained rather more dissolved saline matter than is desirable in a good potable water. No. 18 was drawn from a well at Baroda, and was classed bad, owing to the comparatively large amount of saline matter it contained. No. 19 was from a well at the Cholera Camp, Bhamanikhera, and shows results similar to No. 18. No. 20 was a sample from the Warala tank, Bhiwndi. This water yielded a very high albumenoid ammonia result, and was classed bad. Nos. 21 and 22 were 2 samples forwarded by the Collector, Bijápur—No. 21 drawn from the garden well, and No. 22 from the bath in his garden. Both showed a very large quantity of dissolved saline matter; and in No. 22 the ammonia results were also high. Sample No. 23 was from a well at the G. I. P. Railway Terminus, Bombay, and shows considerable organic contamination. Sample No. 24 was forwarded by the Sanitary Commissioner, and was taken from the iron tank near the entrance to the troops siding, Sassoon Dock, Colába. The results proved the water to be of very good quality.

31. Sample No. 25 was drawn from a well at the Cholera Camp, Buhania, and contained a large quantity of total solids and free ammonia, and was accordingly classed as bad. Nos. 26 and 27 were 2 samples forwarded by the Executive Engineer, Hubli Division, Southern Marátha Railway, from the Castle Rock Station. No. 26 was stated to be from the spring over Bison Lodge, and No. 27 to be from the bed of the stream from which it was intended to supply Castle Rock Station. Both samples were remarkably free from mineral and organic contamination. Sample No. 28 was drawn from a well at the Cholera Camp, Chat, and showed considerable mineral contamination.

32. Analysis No. 29 shows the results obtained from a sample of well water forwarded from Chitrasni Station, on the Rajputána-Málwa Railway. This water yielded a high figure for free ammonia. The figure for total solid was also high. Samples Nos. 30 and 31 were well waters forwarded from Cochin, an opinion being requested both as to their fitness for potable purposes and as to their suitability for making sodawater. Both exhibited very little evidence of organic contamination, and appeared to be well fitted for both purposes. Nos. 32, 33, and 34 were forwarded by the Political Agent, Cutch. The analysis showed No. 32 to be a somewhat brackish water containing chlorides in comparatively large quantity, rendering it unfit for potable use. No. 33 also showed considerable saline contamination, while No. 34 was of good potable quality. Nos. 35 to 41, inclusive, were samples forwarded by the officer in medical charge Station Hospital, Deesa. All appeared to be of good potable quality, and showed little evidence of organic contamination. Sample No. 42 was forwarded by the Sanitary Commissioner, and was drawn from well No. 5, Devláli. This water proved, on anaylsis, to be of good quality. No. 43 was forwarded by the Assistant Engineer, Dhárwár-Gadag section of the Southern Marátha Railway, and from the results of its examination was reported as being entirely unfit for potable purposes. The sample was taken from the station well, Dhárwár. The free ammonia result, it will be noticed, was very high.

33. Sample No. 44 was collected from a well at the Cholera Camp, Dilwara, and showed much dissolved mineral matter. No. 45 was a sample forwarded by the Sanitary Commissioner, and was taken from the stand-pipe on the railway platform, Igatpuri. The results indicated the water to be of very good quality. Sample No. 46 was forwarded by the Executive Engineer, East Berár Division, Hyderabad Public Works Department, and was described as "water from the bottom of the Gulkhera well, Ellichpur Water Works." From the analysis the water appeared to be much contaminated by organic matter. Sample No. 47 was forwarded by the Executive Engineer, Abu Division Rajputána-Málwa

Railway, and was taken from a well at Erinpura. Although fairly free from organic contamination, it contains more total dissolved saline matter than is permissible in a good potable water. No. 48 was drawn from a well at the Gadag Railway Station; the results of its analysis showed it to be of good quality. Samples Nos. 49 to 52, inclusive, were forwarded from Ghadechi by the Executive Engineer, Bhávnagar-Gondal Railway. No. 49 was collected from the Workshop well, No. 50 from the Executive Engineer's Office well, No. 51 from the Manager's well, and No. 52 from the Traffic Superintendent's Office well. All 4 samples contain much dissolved saline matter, and samples Nos. 49, 50, and 52 showed evidence of a greater amount of organic contamination than is allowable in a potable water.

34. No. 53 was a sample drawn from the station well, Girur, and from the analysis proved of good quality. Sample No. 54 was from the Sonaria tank, Gogha, and showed much mineral and organic contamination. Nos. 55 and 56 were forwarded by the Executive Engineer, Sirsa Division, Rewári-Ferozepore State Railway. Sample 55 was taken from the inlet channel of the railway reservoir at Hissar, and sample 56 from the Hissar reservoir. Both samples showed considerable organic contamination. Sample 57 was drawn from the station well, Hubli, Southern Marátha Railway, and proved, on analysis, to be of good quality. Sample 58, from the station well, Hulkote, although containing rather more saline matter than is desirable in a potable water, was found to be otherwise of good quality. Nos. 59, 60, and 61 were 3 samples forwarded by the Civil Surgeon, Jabalpur: No. 59 was collected from the town reservoir, No. 60 from a hydrant in the Cantonment, and No. 61 from a hydrant in the town. All 3 were from the same source of supply, and yielded the same low results for total solids and chlorine, and low results also for free ammonia. Of the 3 samples, 2, *viz.*, Nos. 59 and 60, yielded comparatively high figures for albumenoid ammonia. A high albumenoid ammonia result—coupled, as in the present case, with low figures for free ammonia and chlorine—is to a certain extent an indication of vegetable, not animal, organic contamination. As regards sample No. 60, there was nothing in the results yielded by it to contradict this indication. Microscopic examination of the sediment of No. 59, however, showed coloured cotton fibres and hairs to be present in it. No positive opinion, therefore, as to the source of the organic contamination of this sample could be given solely from the results yielded by it to analysis. The quality of this sample hence is entered in the table as unknown.

35. Sample No. 62 was forwarded by the Assistant Engineer, Hubli, Southern Marátha Railway, and was drawn from the Jowel well. The results of its analysis showed it to be very free both from mineral and organic contamination. Sample No. 63 was forwarded by the Sanitary Commissioner, and was taken from a gurrah on the railway platform, Kalyán. The sample, on analysis, was found to be of good quality. Sample No. 64 was also forwarded by the Sanitary Commissioner, and proved to be remarkably free from saline and organic contamination. It was drawn from the stand-pipe on the station platform, Kására. Samples Nos. 65 to 69, inclusive, were forwarded by the Collector of Thána. No. 65, taken from the Rajani tank, although containing little saline matter, gives a high result for albumenoid ammonia, and would most probably be improved by filtration. Nos. 66 to 69 were drawn from wells, and, No. 69 excepted, show either much saline or much organic contamination. No. 69 was found to be of good quality. Sample No. 70 was forwarded by the Vice-President, Khámgaon Municipality, and shows slightly more organic contamination than is allowable in a good potable water. It, however, yielded comparatively low results for total solids and chlorine. The wholesomeness or otherwise for drinking purposes of a water like this, which shows little evidence of contamination, greatly depends on the nature of the organic impurities present. This is a matter which cannot be definitely ascertained by chemical analysis, but must be inferred from consideration of the surroundings of the water source. Samples Nos. 71 to 74, inclusive, were forwarded from Khárághora by the Executive Engineer for Irrigation, Gujarát. No. 71, from a well, was fairly free from organic contamination, but contained much dissolved saline matter. Nos. 72, 73, and 74 also contain much dissolved solids, and in Nos. 72 and 74 the albumenoid ammonia results were very high.

36. Sample No. 75 was forwarded by the Executive Engineer, Abu Division, B. B. & C. I. Railway, and was found to be a water of good potable quality. No. 76 was forwarded by the Administrative Medical Officer, Quetta, and was described as having been collected from the common water channel at Loralia Bori Valley, Southern Afghánistán. Although containing a somewhat large amount of dissolved saline matter, it was remarkably free from organic contamination. Nos. 77 to 80, inclusive, were samples forwarded from Málegaon, collected from wells in the station; all proved, on analysis, to be of good quality. Samples Nos. 81, 82 and 83 were forwarded by the Executive Engineer, Nasirabad Sub-division, Rajputana Administration, P. W. D. No. 81 was drawn from a well at the Cholera Camp, Motipura, and No. 82 from a well at the Cholera Camp, Nandla. Both samples contained mineral impurities in considerable quantity. No. 83 was drawn from the Dilwara well, Nasirabad, and on analysis proved to be very free from organic contamination. Samples Nos. 84 to 87, inclusive, were also forwarded by the Executive Engineer, Nasirabad Sub-division. Nos. 84 and 85 were samples of Bhir water, filtered and unfiltered. It will be noticed that considerably lower ammonia results were yielded by the filtered than by the unfiltered sample. No. 86 was described as having been drawn from the new well behind the Danta Dam, and was found to be of good potable quality. No. 87 was collected from the Danta Lake, and showed a certain amount of evidence of organic contamination. In this sample the total solids and chlorine being, at the same time, low in amount, a definite opinion as to its quality of the water could not be given without information as to the surroundings of the lake.

37. Sample No. 88 was forwarded from Neemuch by the officer in medical charge, 3rd Bombay Light Cavalry, and was drawn from well No. 2 used by the Native Contingent. The results showed considerable saline contamination; in the sediment, also, cotton fibres and hairs were detected. Analysis No. 89 represents the results obtained on examination of a sample of water from Pishin Fort forwarded by the Administrative Medical Officer, Quetta. The results indicated considerable organic and saline contamination. Nos. 90, 91, and 92 were samples drawn from the Lawrence well, Main Street, Poona, and were forwarded by the Executive Engineer for Irrigation. They were taken from different depths in the same well—No. 90 being from the bottom, No. 91 from midway down, and No. 92 from the surface. Nos. 90 and 91 give high results for free and albumenoid ammonia; No. 92 was found to be better than the other two, the ammonia results being considerably lower; as in this case, the upper stratum of any water, owing to the purifying influence of the atmosphere, is generally of a better quality than the lower strata. Hence water for potable purposes should be taken from near the surface. No. 93 was a sample forwarded from Purandhar Sanitarium; it yielded no albumenoid ammonia, although the free ammonia was rather high.

38. Analyses Nos. 94 to 100 show the results obtained on examination of samples of water from Quetta. No. 94 was collected from the Hanna River close to a gorge five miles north-east of Quetta, and No. 95 from the distribution tank near the Durani villages fed by the Hanna River. No. 96 was taken from the Kasi Karez above the Cantonment on the south-east side, and No. 97 from a well near the Quetta Club. No. 98 was drawn from a spring near the General's compound. No. 99 was taken from Ustabal Nála close to a gorge five miles north-east of Quetta above the level of the Hanna River, and No. 100 from the pool at the foot of the hill on which Upper Urak stands, about 13 miles north-east of Quetta. All these samples were remarkably free from organic contamination, and were reported as potable waters of good quality.

39. No. 101 was forwarded from Saonshi Station, Hubli Division, Southern Marátha Railway. Analysis showed it to contain a large amount of dissolved solids; the free ammonia result yielded by it was also suspiciously high. Sample No. 102 was forwarded by the Huzúr Deputy Collector, Sátára, and was described as Kass water. In this water the total solids and chlorine were small in quantity, while the ammonia results were rather high. In such a case, as before pointed out, a definite opinion as to the quality of a water cannot be given without information as to the nature of the surroundings of the source. As the sediment of the sample under notice, however, was rather abundant, and chiefly

organic, it was suggested that the quality of the water might be improved by filtration. Sample No. 103 was forwarded by the Executive Engineer, Sirsa Division, Rewári-Ferozepore (State) Railway, and was drawn from a well near the Satrod Station. The results show much saline and organic contamination, the ammonia results being very high. Samples Nos. 104 and 105 were also forwarded by the Executive Engineer, Sirsa Division, Rewári-Ferozepore (State) Railway. No. 104 was of good quality; but No. 105, as may be seen from the analysis, proved to be much too highly charged with saline and organic matter to be fit for potable purposes. Analyses Nos. 106 and 107 show the results obtained on examination of waters from Sirúr. Both samples are so highly charged with saline matter as to be unsuitable for drinking purposes.

40. No. 108 was drawn from the stand-pipe on the railway platform, Thána, and was forwarded by the Sanitary Commissioner. According to the results of analysis, the water was of good quality. Sample No. 109 was forwarded by the Chief Engineer, Baroda State, and was labelled "Parsoli well water." The results of its analysis indicated it to be a water of fair quality. No. 110 was drawn from the Unjha Station well, and forwarded by the Executive Engineer, Abu Division, B. B. & C. I. Railway. This water was found to contain more dissolved total solids and to show evidence of a greater amount of organic contamination than is permissible in a good potable water. Sample No. 111 was taken from a gurrah on the station platform, Wassina, and forwarded by the Sanitary Commissioner; it proved to be a good potable water. No. 112 was forwarded by the Assistant Engineer, Hubli Division, Southern Marátha Railway, and was described as water from the station well, Yalrigi; it was found, on analysis, to be remarkably free from organic contamination, and classed as good.

Number.	Station.	Date of Collection.	Source.	Grains per Gallon.		Parts per Million.		Column added by order of Government	Sediment.
				Total Solids.	Chlorine	Ammonia.			
						Free.	Albuminoid.		
1	Aden Kusat Valley.	December	Well No. 2	51·80	15·68	·08	·03	Bad ..	Not abundant, vegetable debris, paramecia, a few rotifers, sand.
2	Do.	Do.	Do. No. 3	45·50	11·07	·80	·14	Do. ..	Do. do., many paramecia, coloured cotton fibres, hairs.
3	Do. ..	Do.	Do. No. 4	58·80	16·10	*Nil.*	·15	Do. ..	Do. do., particles of sand, no infusoria.
4	Do. ..	Do.	Do. No. 8	270·90	93·80	*Nil.*	·07	Do. ..	Do. do., a few rotifers.
5	Do. ..	Do.	Do. No. 9	238·40	99·40	*Nil.*	·12	Do. ..	Scanty do. do., no infusoria.
6	Do. ..	Do.	Do. No. 10	315·70	95·90	*Nil.*	·20	Do. ..	Do. do. do., a few paramecia.
7	Do. ..	Do.	Do. No. 11	266·00	78·80	*Nil.*	·06	Do. ..	Do., chiefly sand, no infusoria.
8	Do. ..	Do.	Do. No. 20	376·60	133·00	*Nil.*	·02	Do. ..	Rather scanty, chiefly sand, a few paramecia.
9	Do. ..	Do.	Bakery well	2338·00	784 00	..	..	Do. ..	Do., chiefly sand, no infusoria.
10	Ahmedabad ..	May	Camp well	35·00	1·96	·03	·15	Good ..	Very scanty, vegetable debris.
11	Annigeri ..	April..	Station well	33·60	3·08	·09	·11	Do. ..	Scanty, few paramecia, vegetable debris.
12	Asirgarh .	May	Sukkur well	16·80	2·24	·05	·26	Bad ..	Scanty, vegetable debris, paramecia, rotifers.
13	Do. ..	July	Well recently cleaned ..	26·60	1·05	·05	·12	Good ..	Very scanty, vegetable debris, no infusoria.
14	Do. ..	August ..	Sukkur well	25·20	0·98	·03	·02	Do. ..	Scanty vegetable debris, no infusoria.
15	Aurangabad ..	June..	Water Tower, Begampura source.	23·10	1·54	·12	·09	Do. ..	Scanty, sand, vegetable debris, monads, paramecia.
16	Do. ..	Do.	Hospital well	49·00	5·11	·07	·09	Good, ..	Rather abundant, sand, vegetable debris, a few paramecia.
17	Do. ..	Do.	Well, south of Cantonment bridge.	36·40	3·92	·05	·08	Do. ..	Scanty, sand, vegetable debris, a few paramecia.
18	Baroda	February	Well	68·60	10·67	·08	·06	Bad ..	Rather abundant, protozoa, vegetable debris.
19	Bhawanikhera..	August	Well, Cholera Camp ..	61·60	14·28	·05	·03	Do. ..	Do. vegetable debris, a few paramecia
20	Bhiwndi ..	March	Warala tank	4·20	·91	·13	·64	Do. ..	Abundant, few paramecia, vegetable debris.
21	Bijápur ..	November	Garden well (Collector's)	380·10	93·94	·16	·14	Do. ..	Scanty, mostly vegetable debris, monads, paramecia.
22	Do. ..	Do.	From bath (Collector's)	376·40	100·80	·64	·23	Do. ..	Scanty, mostly sand, fragments of insects, &c.
23	Bombay ..	February	Well, G. I. P. Railway Terminus.	39·90	6·44	·07	·26	Do. ..	Scanty, few protozoa, vegetable debris.

Number.	Station.	Date of Collection.	Source.	Grains per Gallon.		Parts per Million.		Column added by order of Government	Sediment.
				Total Solids.	Chlorine	Ammonia.			
						Free.	Albumenoid.		
24	Bombay ..	December	Iron tank, Sassoon Dock.	4·90	0·77	*Nil*	·06	Good ..	Very scanty, a little vegetable debris and sand, no infusoria.
25	Buhania ..	August..	Well, Cholera Camp ..	63·70	6·30	·55	·15	Bad ..	Scanty, vegetable debris, a few paramecia.
26	Castle Rock ..	May	Spring over Bison Lodge	2·80	·56	·03	·06	Good ..	Very scanty, chiefly vegetable debris, no infusoria.
27	Do. ..	Do.	From bed of stream, &c.	1·40	·56	·02	·12	Do. ..	Do. do.
28	Chat	August	Well, Cholera Camp ..	46·20	8·82	·13	·09	Bad ..	Rather abundant, vegetable debris, a few paramecia.
29	Chitrasni ..	June..	Station well (new) ..	64·40	5·53	·53	·11	Do. ..	Rather abundant, vegetable debris, many paramecia.
30	Cochin.. ..	January	G. well	21·70	1·68	·02	·01	Good ..	Scanty, few protozoa, vegetable debris.
31	Do.	Do.	K. well	28·00	5·74	*Nil*	·04	Do. ..	Do. do.
32	Cutch	May	Old boring	100·10	36·40	·17	·22	Bad ..	Abundant, fine clay, vegetable debris.
33	Do. .. .	Do.	Sarad Bág	41·30	10·64	·12	·22	Do. .	Less abundant, fine clay, vegetable debris.
34	Do.	Do.	New boring	13·90	3·36	·11	·16	Good ..	Scanty, chiefly vegetable debris.
35	Deesa	June	Hospital well, 19th Bombay Infantry.	35·00	3·92	·05	·06	Do. ..	Scanty, sand, vegetable debris, few paramecia.
36	Do.	Do.	Line well do. do..	28·70	3·59	·05	·03	Do. ..	Very scanty, sand, vegetable debris, no infusoria.
37	Do.	Do.	Line well S., 2nd Bombay Lancers.	31·50	4·76	*Nil*	·08	Do. ..	Scanty, sand, vegetable debris, one prostomum turbellaria.
38	Do.	Do.	Line well N. do. ..	24·50	4·62	·05	·07	Do. ..	Scanty, vegetable debris, sand, a few paramecia.
39	Do.	Do.	Line well, Detachment E.7th Regiment.	30·80	3·92	·04	·02	Do. ..	Do. do. do., no infusoria.
40	Do.	Do.	Old Artillery Hospital well.	22·40	2·80	·01	·02	Do. ..	Do. do. do., a few paramecia
41	Do.	October	Well, DetachmentE.-7th Regiment Lines.	30·10	3·36	*Nil*	·06	Do. ..	Not abundant, sand, vegetable debris, a few paramecia.
42	Devlálí.. ..	December	Well No. 5	21·00	1·54	*N*	·11	Do. ..	Very scanty, a few diatoms and paramecia, with some sand.
43	Dhárwár ..	April	Station well	51·80	18·48	1·07	·29	Bad. ..	Rather abundant, fine clay, and vegetable debris.
44	Dilwara ..	August	Well, Cholera Camp ..	82·60	20·72	·11	·08	Do. ..	Abundant, fine clay, vegetable debris, no infusoria.
45	Igatpuri ..	December	Stand-pipe, railway platform.	2·10	0·42	*Nil*	·12	Good ..	Scanty, mostly vegetable debris, diatoms, confervæ.
46	Ellichpur ..	Do.	Bottom of Gulkhera well.	20·30	0·98	*Nil*	·60	Bad ..	Not abundant, vegetable debris, no infusoria.
47	Erinpura ..	February	Erinpura well	57·40	11·48	·19	·14	Do. ..	Scanty, few protozoa, vegetable debris
48	Gadag ..	April	Gadag Station well ..	53·10	1·96	*Nil*	·12	Good ..	Scanty, few paramecia, vegetable debris.
49	Ghadechi ..	Do.	Workshop well .. .	130·20	28·98	·72	·46	Bad ..	Scanty, vegetable debris.
50	Do. ..	Do.	Executive Engineer's Office well.	109·90	35·56	·40	·34	Do. ..	Do. do.
51	Do. ..	Do.	Manager's well	105·70	42·12	·21	·14	Do. ..	Do. do. few monads.
52	Do. ..	Do.	Traffic Superintendent's Office well.	93·10	34·02	·27	·32	Do. ..	Do. paramecia.
53	Girur	May	Station well	28·00	4·51	·03	·12	Good ..	Rather abundant, fine clay, vegetable debris, no infusoria.
54	Gogha	July	Sonaria Tank	86·10	30·10	·13	·30	Bad ..	Considerable sand, vegetable debris, monads, paramecia.
55	Hissar	September	Railway reservoir inlet channel.	23·10	2·31	·16	·53	Do. ..	Scanty, vegetable debris, paramecia.
56	Do.	Do.	Hissar reservoir ..	7·70	0·84	*Nil*	·31	Do. ..	Do. do.
57	Hubli	October	Station well	30·80	3·02	·16	·04	Good ..	Scanty, vegetable debris, no infusoria.
58	Hulkote ..	April	Hulkote Station well ..	30·90	3·88	·16	·15	Do. ..	Scanty, few diatoms, vegetable debris.
59	Jabalpur ..	October	Town reservoir ..	3·5	·21	·04	·29	Unknown..	Not large, vegetable and animal debris, confervæ.
60	Do. ..	Do.	Hydrant, Cantonment .	3·5	·21	·02	·24	Good ..	Scanty, vegetable debris, actinoph. sol, confervæ, paramecia.
61	Do. ..	Do.	Hydrant, City	3·5	·21	*Nil*	·10	Do. ..	Do. do. sand confervæ.
62	Jowel	Do.	Well	16·10	4·06	·11	·04	Do. ..	Rather abundant, vegetable debris, fine clay, no infusoria.
63	Kaliyán ..	December	Gurvah, railway platform.	19·60	3·29	·05	·11	Do. ..	Very scanty, mostly confervæ, paramecia, and sand.
64	Kására	Do.	Stand-pipe, railway platform.	2·10	·42	·05	·10	Do. ..	Scanty, mostly vegetable debris, few confervæ, paramecia, actinophrys sol, rotifers, a little sand.
65	Kelvi Máhim ..	February	Rajáni tank	2·80	1·47	·01	·36	Bad ..	Rather abundant, vegetable debris.
66	Do. ..	Do.	Well No. 2	109·20	21·98	·01	·20	Do. ..	Scanty do.
67	Do. ..	Do.	Do. No. 3	75·60	14·00	·05	·26	Do. ..	Do. do.

Number.	Station.	Date of Collection.	Source.	Grains per Gallon.		Parts per Million.		Column added by order of Government.	Sediment.
				Total Solids.	Chlorine.	Ammonia.			
						Free.	Albumenoid.		
68	Kelvi Máhím ..	February	Well No. 4	49·70	6·58	·01	1·10	Bad ..	Scanty, few monads, vegetable debris.
69	Do. ..	Do.	Do. No. 5	46·20	7·56	·08	·07	Good ..	Do. do.
70	Khámgaon ..	Do. .. .	Khámgaon tank ..	11·90	·84	·11	·21	Unknown .	Scanty, many protozoa, vegetable debris.
71	Khárághora ..	January	Khárághora well ..	82·60	33·60	·05	·02	Bad ..	Scanty, paramecia, vegetable debris.
72	Do. .	Do.	Do. tank ..	80·50	38·36	·21	1·02	Do. ..	Do. do.
73	Do. ..	Do.	Do. from outside the tank.	111·30	49·00	·11	·29	Do. ..	Do. few monads, vegetable debris.
74	Do. ..	May	Do. new tank.	186·90	98·00	·80	1·34	Do. ..	Scanty, vegetable debris, many paramecia.
75	Khodiar ..	June	Station well	32·20	3·57	·02	·20	Good ..	Rather abundant, vegetable debris, many paramecia.
76	Loralia Bori Valley.	December	Common water channel.	39·20	4·27	·04	·02	Do. ..	Scanty, mostly fine clay, a little vegetable debris, and few monads and diatoms.
77	Málegaon ..	November	Well 1, Depôt, 25th Regiment Native Infantry.	23·80	1·54	·04	·06	Do. ..	Scanty, vegetable debris, sand, confervæ, a few paramecia.
78	Do. ..	Do.	Well 2, behind Quarter Guard.	26·60	1·68	·04	·08	Do. ..	Do. many paramecia, confervæ, wings of insects.
79	Do. ..	Do.	Well 3, behind Storeroom.	22·40	1·40	·03	·06	Do. ..	Very scanty, vegetable debris, diatoms, confervæ, rotifers few.
80	Do. ..	Do.	Well No. 4, in front of church.	20·30	2·10	*Nil.*	·04	Do. ..	Scanty, no infusoria, dark-coloured sand.
81	Motipura ..	August	Well, Cholera Camp ..	66·50	12·32	·16	·16	Bad ..	Scanty, vegetable debris, a few paramecia.
82	Nandla ..	Do.	Do. do. ..	49·00	16·66	·11	·02	Do. ..	Scanty, vegetable debris, no infusoria.
83	Nasirabad ..	Do.	Dilwara well	27·30	3·57	·01	·01	Good ..	Do. do.
84	Do. ..	Do.	Bhir water (filtered) ..	17·50	4·97	*Nil.*	·22	Bad ..	Do. do.
85	Do. ..	Do.	Do. (unfiltered).	24·50	4·83	·05	·40	Do. ..	Scanty, clay, no infusoria.
86	Do. ..	Do.	New well behind Danta Dam.	37·10	5·25	*Nil.*	·18	Good ..	Do. do.
87	Do. ..	Do.	Danta Lake	14·00	0·56	·13	·24	Bad ..	Do. do.
88	Neemuch ..	July	Well No. 2 for Native Contingent.	34·70	11·34	·09	·03	Do. ..	Scanty, monads, paramecia, actinoph sol.
89	Pishin	December	Pishin Fort water ..	173·60	51·10	·03	·36	Do. ..	Rather abundant, vegetable debris, a few paramecia, mostly fine clay.
90	Poona	June	Lawrence well, Main Street, bottom.	39·20	4·90	·96	·20	Do. ..	Do. vegetable and animal debris, paramecia.
91	Do.	Do.	Do. do. midway.	35·70	5·32	·94	·28	Do. ..	Scanty, vegetable debris and paramecia.
92	Do.	Do.	Do. do. surface .	34·30	4·20	·16	·11	Good . ..	Do. do.
93	Purandhar ..	October	Commissariat Contractor's well.	12·6	0·91	·32	Nil.	Do. ..	Do. a few paramecia.
94	Quetta	November	Hanna River	36·40	4·27	*Nil.*	·09	Do. ..	Rather abundant, vegetable debris, clay, monads, paramecia, rotifers.
95	Do.	Do.	Durani village	21·00	1·33	·014	·02	Do. ..	More abundant, fine clay, a few paramecia.
96	Do.	Do.	Kasi Karez above Cantonment.	24·50	1·33	Trace.	Trace.	Do. ..	Scanty, fine clay, no infusoria.
97	Do.	December	Well near Quetta Club	21·00	1·68	*Nil.*	·08	Do. ..	Very scanty, a few monads, mostly fine clay.
98	Do.	Do.	Spring near General's compound.	18·90	1·68	*Nil.*	·20	Do. ..	Do. a little vegetable debris, fine clay, no infusoria.
99	Do.	Do.	Ustabul	26·60	3·85	*Nil.*	·06	Good ..	Rather abundant, vegetable debris, monads, paramecia, rotifers, clay.
100	Do.	Do.	Urak	11·20	0·56	*Nil.*	·02	Do. ..	Scanty, vegetable debris, a few paramecia, clay.
101	Saonshi ..	Do.	Station well	91·00	18·20	·32	·12	Bad ..	Scanty, vegetable debris, a little clay, paramecia.
102	Sátára	June	Kass water	1·40	·63	·19	·24	Do. ..	Rather abundant, vegetable debris, confervæ, and paramecia.
103	Satrod	September	Well near Satrod Station.	723·80	250·60	1·86	2·24	Do. ..	Not large, vegetable debris, no animal forms, foul smelling.

Number.	Station.	Date of Collection.	Source.	Grains per Gallon.		Parts per Million.		Column added by order of Government.	Sediment.
				Total Solids.	Chlorine.	Ammonia.			
						Free.	Albuminoid.		
104	Sirsa	May	Suchan well	28·00	1·54	·03	·11	Good ..	Rather abundant, vegetable debris, no infusoria.
105	Do.	July	Well 50/4	294·70	107·10	1·60	1·20	Bad ..	Scanty, many paramecia, diatoms, confervæ.
106	Sirūr	December	Pipe water (from tank).	158·90	23·80	·05	·12	Do. ..	Rather abundant, mostly monads, confervæ, fine clay.
107	Do.	Do.	Tank	159·60	23·80	·05	·13	Do. ..	Very scanty, vegetable debris, a few rotifers, some clay.
108	Thāna	Do.	Stand-pipe, railway platform.	14·00	1·05	·03	·14	Good ..	Very scanty, vegetable debris, a few rotifers and sand.
109	Umrat	Do.	Parsoli well	37·10	8·19	·21	·18	Bad ..	Rather scanty, mostly vegetable debris, monads, many paramecia, a few rotifers, and some clay.
110	Unjha	April	Unjha Station well ..	77·70	6·58	·03	·40	Do. ..	Scanty, many paramecia, vegetable debris.
111	Wassina ..	December	Gurrah, railway platform.	25·20	8·75	·16	·11	Good ..	Very scanty, mostly vegetable debris, confervæ, paramecia, and sand.
112	Yalrigi	Do.	Station well	42·70	9·10	·03	·03	Do. ..	Very scanty, vegetable debris, no infusoria.

Section III.—Government Stores.

41. The articles coming under this description, examined during the past year, comprised:—

Commissariat Stores.

Samples of malt liquor	...	...	...	139
„ lime-juice	...	...	...	120
„ tea ...	...	...	...	19
„ sugar ...	...	...	...	28
„ sundry articles of food		...	...	10
„ wines and spirits	...	...	...	8
„ soap ...	...	...	...	28
„ disinfectants	...	...	...	11
„ kerosine oil	...	...	...	4
„ oils ...	...	...	...	3
„ sundry articles	...	...	...	14
				384

Ordnance Stores.

Samples of mercuric fulminate	...	...	...	45
„ gunpowder	...	...	...	4
„ metals and alloys	...	...	...	7
„ sundry stores	...	...	...	4
				60
				444

The corresponding number of articles for 1885 was 348.

42. *Malt Liquor.*—Of the 139 samples of malt liquor examined during the year under report, 8 were samples from 2 consignments of porter and ale

imported by Government for the use of troops. These 8 samples were taken—2 per cask—from 2 casks of ale and 2 of porter, one sample being drawn on arrival of the consignment, and the other six days after landing it. The table below shows the results obtained on examination of the second drawn-sample from each cask :—

Brewery Number.	Description of Liquor.	Extract Gravity.	Beer Gravity.	Original Gravity.	Alcohol by volume per cent.	Acidity as Hydrated Acetic Acid per cent.
1 ...	Ale ...	1016·6	1007·3	1058·1	6·64	·34
„ ...	Do. ...	1016·9	1007·3	1057·9	6·56	·30
2 ...	Porter ...	1016·7	1007·1	1059·7	6·87	·31
„ ...	Do. ...	1016·6	1007·1	1059·1	6·80	·32

43. 131 of the samples, *viz.*, 129 of ale and 2 of porter, were samples of Government malt liquor sent from Saugor, and alleged to have bcome unfit for issue. Of these, 23 samples were forwarded in May from Saugor at the request of the Executive Commissariat Officer, Jabalpur—22 being samples of ale, and one a sample of porter brewed at Mussoorie. Of these, 3 samples of ale were found to be wholly decomposed and unfit for use. The remaining 20 samples appeared to have been of good original quality, but to have become more or less altered by age. In 2 of them—both samples of ale—the acidity (reckoned as acetic acid) had risen to over 45 per cent.; 10—9 samples of ale and one of porter—had an acidity of between ·35 and ·45 per cent., and in the remaining 11 the acidity was under ·35 per cent. In December, 107 samples of ale and one sample of porter were forwarded also from Saugor, condemned there by a special committee as absolutely unwholesome and unfit to drink. These samples were received through the Commissary General, Bombay. Of the 108, 6 samples of ale appeared to have become partially decomposed. The remaining samples were all more or less turbid, and altered by age, many containing excess of acidity. In 17 of them—all samples of ale—the acidity, reckoned as acetic acid, amounted to ·55 per cent. or over, 1 sample reaching 1·12 per cent.; 23—all samples of ale—had an acidity of between ·45 and ·55 per cent.; 26—all samples of ale—had an acidity between ·35 and ·45 per cent., while in the remaining 42 the acidity was under ·35 per cent.

44. *Lime-juice.*—120 samples of lime-juice were examined during the year; of these, 15 were fortified and 105 unfortified. Of the former 3 and of the latter 17 were rejected on the ground of inferiority of quality. One of the rejected samples (unfortified) was found to have a specific gravity of 1026, and to contain under 3·0 per cent. of citric acid, and another (fortified) forwarded from Aden was found to contain only 4·35 per cent. of citric acid. All the unfortified samples of lime-juice accepted, with the exception of 4, contained over 6 per cent. of free citric acid, the average for the 88 accepted samples being 6·55 per cent. The best sample, unfortified, was one received, through the Commissariat, from H. M.'s ship "Kingfisher," which had a specific gravity of 1040, and contained 8·20 per cent. of free citric acid.

45. *Tea.*—Of the 19 samples of tea—all Indian—examined during the year, it was found necessary to reject 7. The average results obtained, on examination of the 12 accepted samples, were as follows:—

Specific gravity of a 10 per cent. decoction	1009·99
Soluble ash per cent.	3·39
Insoluble do.	2·65
Total ash	6·04

46. *Sugar and Sundry Articles of Food.*—28 samples of sugar were examined during the year, and compared with the standard musters. These

were mostly of good quality, and call for no special remark. 6 samples of Indian arrowroot were examined. 5 of these were forwarded in the month of February, one being a sample prepared by Mr. Náráyen Gogte at Dápoli in Ratnágiri, and the other 4 samples supplied by the contractors at, respectively, Bombay, Poona, Mhow, and Karáchi. Mr. Gogte's sample and the one tendered at Mhow were found to be maranta arrowroot of good quality. This kind of arrowroot is obtained from the rhizomes of *maranta arundinacea* and is also known in the market as Jamaica or St. Vincent arrowroot. The other 3 samples were found to be Rio or manihot arrowroot of good quality. This arrowroot is obtained from the plant *manihot utilissima*. Dr. Hassall (On Adulteration of Food, p. 370) with reference to manihot arrowroot writes :—" To the application of the word arrowroot to the fecula of this plant there exists no objection, since it resembles closely the other arrowroots in its properties." Another sample was forwarded in December, and was labelled " Sample of country arrowroot tendered by Náráyen Ramchander : " this proved, on examination, to be a sample of good maranta arrowroot. 2 samples of wheat and one sample of bread, and subsequently a sample of the flour of which the bread was made, were forwarded from Poona. A complaint had been made about the bread that it was heavy and non-aerated. The flour was obtained from a mixture of the two kinds of wheat sent. The flour and the two samples of wheat were found, on examination, to be of good quality. The flour was baked into loaves by a baker in Bombay. The bread produced was light and spongy, and altogether of a better quality than the sample forwarded from Poona. The non-aeration of the bread was evidently due to some error in the manipulation of the flour in the bakery at Poona. One sample of essence of vinegar was found to contain 84 per cent. of acetic acid, and to be of good quality.

47. *Wines and Spirits.*—3 samples of sherry and one of port were examined. The selected sample of sherry and the sample of port, which was of good quality, yielded the following results :—

	Sherry.	Port.
Alcohol by volume per cent.	17·4	21·3
Extractive do.	2·18	8·90
Acidity as tartaric acid do.	·39	·28

4 samples of brandy were also examined ; all appeared to be genuine. 2 were samples from Commissariat stock, and 2 were tendered by contractors. These last yielded the following results to analysis :—

	1	2
Degree of proof U. P.	9·9	12·8
Alcohol by volume per cent.	51·4	49·6
Acidity as tartaric acid do.	·04	·04
Extractive per cent.	2·46	1·00

48. *Soap.*—The 28 samples of soap examined during the year were all of Indian manufacture, and comprised one sample of tablet soap (carbolic acid), 3 samples of soft soap, and 24 samples of bar soap. The quantity of water present in the sample of tablet soap was 21·8 per cent. In the 3 samples of soft soap the moisture ranged from 36·5 to 38·1 per cent. Of the 24 samples of bar soap, 4 contained between 30 and 40 per cent., 2 between 40 and 50, 15 between 50 and 60, and 3 over 60 per cent. of water. It will thus be seen that in a large number of the samples there was a large excess of moisture. When the moisture exceeds a fixed limit, the contractor has to make good the loss entailed thereby.

49. *Disinfectants.*—11 samples of disinfecting powder were examined, of which 8 were tendered to the Commissariat as Calvert's disinfecting powder. Of these, 3 were found to correspond to the above description, and contained 15 per cent. of carbolic acid, as stipulated. The 5 others were not samples of Calvert's disinfecting powder, *i.e.* were powders decomposable by hydrochloric acid, and all contained less than the required percentage of carbolic acid. Of these 5 samples, one at least was stated to have been taken from a cask bearing Messrs.

Calvert's label, and the cask was afterwards produced bearing the label. 3 other samples of disinfecting powder were examined. 2 of these were found to be Calvert's disinfecting powder, containing, respectively, 10 per cent. and 7 per cent. of carbolic acid; the third was a sample of McDougall's powder containing 3 per cent. of carbolic acid.

50. *Kerosine Oil, &c.*—4 samples of kerosine and 3 samples of neat's foot oil were examined. The samples of kerosine flashed between 75° and 81° Abel. Of the 3 samples of neat's foot oil, one was found to be genuine. One sample of American tobacco was examined, and found to be of fair quality. 2 samples of tin, for tinning vessels, were examined, and found free from lead or other impurity. 9 Sykes' hydrometers were compared with the standards, and tables of correction made out. One sample of linseed cake, manufactured by machinery recently imported from England, was examined, and found to be of good quality. Lastly, one sample of earth, called by the natives "Khára" or alkaline, from the Khárpoi kuran of the Aligaon Farm, on which no grass grows, was examined, with a view to the finding of any means of improving the fertility of the soil. The soil was found to contain only a very minute quantity of matter soluble in water, the greater portion of which was common salt. Except this deficiency in soluble constituents, nothing could be found in the sample to account for the want of fertility complained of. This, then, was rather to be attributed to the absence, from the soil, of fertilising matters, than to the presence, in the soil, of any saline or other matter acting injuriously on plant nutrition.

51. *Ordnance Stores.*—45 samples of mercuric fulminate were qualitatively examined for the Small Arms Ammunition Factory, Kirkee. All were found free from acidity, and apparently of good quality. 2 samples of spirits of wine, one of bees' wax, one of shell lac, and one of lead were also examined for the same factory. The spirits of wine, bees' wax, and shell lac were all found to be of good quality. The sample of lead contained 98·56 per cent. of pure lead and ·2 per cent. of tin. 4 samples of gunpowder were examined at the request of the Superintendent, Government Gunpowder Factory, and yield the following results to analysis :—

Undried Samples.	1	2	3	4
Nitre	74·80	74·70	75·10	74·20
Sulphur	9·97	10·09	10·04	10·05
Charcoal (by difference)	15·23	15·21	14·86	15·75
	100·00	100·00	100·00	100·00

3 samples of lead alloyed with antimony in small quantity were examined quantitatively at the request of the Executive Engineer, Bombay Defences; and, lastly, at the request of the same officer, 3 samples of metallic antimony were examined, all of which proved to be free from impurities.

Section IX.—Customs and A'bka'ri Analyses.

52. During the year under report, 479 samples of various substances were forwarded for examination by the Customs and Abkári Departments. These comprised —

Samples of alcoholic liquids	...	...	...	118
„ „ opium ...	...	...	...	16
„ „ salt ...	...	...	...	2
„ „ explosives	...	...	...	12
„ „ petroleum	...	...	...	331
				479

The corresponding number for 1885 was 576.

53. *Alcoholic Liquids.*—Of the 118 samples of alcoholic liquids submitted for report during the year, 34 were samples of medicinal and other preparations, which on examination proved to be free from alcohol. 25 more were samples of medicinal liquids containing alcohol : of these, 12 were found to contain less than 20 per cent. of proof spirit. The alcoholic strength of the other 13 was as follows :—5 contained under 30 per cent., 5 between 30 and 40 per cent., and 3 between 40 and 60 per cent., of proof spirit. 19 were samples of flavouring essences : of these, 7 were under proof. Of the remaining 12, all over proof, 4 were under 20 per cent., 4 between 20 and 40 per cent., and 4 between 40 and 50 per cent. over proof. 11 were samples of sweetened and flavoured mowra spirit ranging in strength from 62·4 to 39·8 per cent. under proof. 7 were samples of Eau de Cologne and other perfumed spirits, only one of which was below proof. 12 more comprised 6 samples of brandy, 4 of gin, and 2 of whiskey. Of these both the whiskey samples and 2 of the brandy samples were slightly over proof. Of the 4 samples of gin only one was over proof. The alcoholic strength of this sample was 30·6 per cent. over proof, or very much higher than the strength at which this spirit is usually retailed. The remaining 9 samples comprised one sample each of rum, Angostura bitters, and ginger cordial, 2 samples of methylated spirits of wine, and 4 samples of wood spirit.

54. *Opium.*—Of the 16 samples of opium examined during the year, 8 were forwarded from Násik and 8 from Kaira. Of the Násik samples, 4 on examination proved to be of good quality, 2 were found to be adulterated, but not to any very great extent, with foreign vegetable matter, and 2 contained realgar (red sulphide of arsenic). This adulterant has been before found in samples of opium from Násik (see this Office Report for 1882-83, para. 62) : apparently, therefore, its presence is not accidental. The 8 Kaira samples were forwarded at the request of the Collector ; all were unusually dry, the quantity of moisture present ranging between 5 and under 6½ per cent. 2 were inferior in quality to the other 6, yielding, respectively, 55·5 and 58·3 per cent. of watery extract (calculated on the dry opium) as compared with an average of 65·4 per cent. in the other 6 samples.

55. *Salt and Explosives.*—Of the 2 samples of salt one was described as Panchbhadra salt ; this yielded 96·40 per cent. of chloride of sodium. The foreign matters present were insoluble residue ·61 per cent., sulphate of lime 1·70 per cent., and traces of chloride of magnesium. The other was described as Khárághora salt, and yielded 97·86 per cent. of chloride of sodium. The insoluble residue of this sample was only ·27 per cent., and no chloride of magnesium was present in it. The 12 samples of explosives were all samples of dynamite taken from two consignments of, respectively, 400 and 600 cases ; all passed the " heat test."

56. *Petroleum.*—331 samples of petroleum were examined, under the provision of the Petroleum Act, during the year. Of these, 322 were samples taken from the cargoes of the 18 petroleum-laden ships which arrived at Bombay from America during 1886. These 18 ships brought altogether about 950,000 cases. All 322 samples flashed above the legal minimum of 73° Abel. One only of the 18 ships yielded samples flashing below 76° Abel. The ship, referred to, brought over 63,000 cases, certified by a firm of American inspectors to flash at 76° to 78° Abel. Of 18 samples taken from the cargo of this ship, 4 flashed at 74° and 5 at 75°, while the other 9 all flashed between 76° and

79° Abel. This cargo excepted, none of the others yielded samples flashing below the minimum Abel flash given for the cargo in the American certificate. In 8 cases the American certificate accompanying the cargo stated both the minimum and maximum Abel flash thereof. One of these was the ship referred to above. The table below shows the results obtained from the other 7 :—

	Range of Abel flash given in American Certificate.		Results obtained in Bombay.		Number of Samples tested in Bombay.	Number found above maximum stated in American Certificate.
	Minimum.	Maximum.	Minimum.	Maximum.		
(1)	76°	78°	76°	79°	20	1
(2)	76°	78°	76°	79°	18	2
(3)	76°	78°	76°	80°	18	2
(4)	76°	79°	76°	78°	18	0
(5)	76°	79°	76°	79°	18	0
(6)	76°	79°	77°	83°	18	6
(7)	76°	80°	78°	82°	18	1

These results, it will be noticed, by no means tend to support the theory that petroleum is liable to undergo a depression of its flashing point during transit between America and India.

57. Of the remaining 9 samples of petroleum, 4 were taken—2 each—from 2 small consignments of Russian oil. Of these 2, from one consignment, flashed at respectively 73° and 74° Abel, and the 2 from the other at respectively 75° and 76° Abel. 2 more were samples from a small consignment imported from Mohumra ; both these flashed at 89° Abel. The remaining 3 samples were (1) a sample of Rangoon oil, (2) a sample of naptha, and (3) a sample of benzine. Of these the first mentioned flashed considerably above, and the other 2 much below, the legal minimum.

Section V.—Miscellaneous.

58. The 92 examinations of articles coming under this head comprised—

Samples of	water	3
Do.	limestones and limes	14
Do.	alcoholic liquids	19
Do.	milk and ghee	16
Do.	minerals and deposits	14
Do.	sundry substances	26
		92

The corresponding number for 1885 was 88.

59. *Water.*—Of the 112 samples of potable water included in the table following Section II. of this report, 23 were further examined. In the case of 9 of these it was not deemed necessary to do more than determine the amount of combined sulphuric acid present. 14 samples were more fully examined, as also 3 other samples not included in the table following Section II. The results yielded by these 17 samples are shown in the next table. Of the 17 Nos., 1 to 6 were sent by the Commissariat Department from various wells at Aden, the object being to ascertain whether it was possible to substitute with advantage some other water for that of the Bakery well (No. 6 of the table). The water of this Bakery well, it was stated, was found to give rise to a large amount of deposit in a boiler fed with it. As will be seen from the

table, the water of the Bakery well contained 8 or 9 times as much dissolved saline matter as the others and over 40 times as much as the water of Aden wells Nos. 2, 3, and 4: see page 15. Samples 7 to 15 were sent by the engineers of various railways to be examined as to their fitness, or otherwise, for use in locomotives,—Nos. 7 to 9 being from various stations on the Southern Marátha Railway, 10 and 11 from two stations on the Rájputána-Málwa Railway, 12 and 13 from stations on the Rewári-Ferozpore Railway, and 14 and 15 samples of, respectively, river and well water from Seoni, on the Great Indian Peninsula Railway. Sample No. 16 was sent by the Chief Engineer, Baroda State, an opinion being requested as to its fitness, or otherwise, for making into soda water; and No. 17 was a sample of river water sent by a merchant from Ahmedabad to be examined as to its suitability, or otherwise, for use in a dyeing factory:—

No.	Forwarded by	Source.	Grains per Gallon.				
			Total Solids.	Chlorine.	Sulphuric Acid.	Lime.	Magnesia.
1	Commissary General.	Aden well No. 8	270·90	93·80	28·55	22·34	4·41
2		Do. No. 9	288·40	99·40	32·59	26·73	4·87
3		Do. No. 10	315·70	95·90	29·03	29·71	6·74
4		Do. No. 11	266·00	78·80	28·84	49·60	5·12
5		Do. No. 20	376·60	133·00	28·74	26·50	8·92
6		Aden Bakery well	2,338·00	784·00	88·83	285·84	69·77
7	S.-M. Railway ...	Dhárwár Station well	51·80	18·48	Trace	5·46	3·36
8		Seonshi do.	91·00	18·20	7·88	13·58	7·00
9		Yalrigi do.	42·70	9·10	*Nil.*	15·40	5·60
10	R.-M. Railway ...	Erinpura well	57·40	11·48	2·50	5·49	1·96
11		Unjha Station well	77·70	6·58	5·25	1·68	Trace.
12	R.-F. S. Railway...	Satrod do.	723·80	250·60	69·78	70·42	59·50
13		Sirsa well 50/4	294·70	107·10	33·26	21·17	25·30
14	G. I. P. Railway ..	Seoni river water	39·20	3·08	0·28	5·74	3·85
15		Do. well water	53·90	2·38	0·28	8·68	3·78
16	.....	Baroda well	68·60	10·67	9·38	9·10	8·33
17	.....	Ahmedabad River	26·60	4·97	0·77	3·45	2·74

60. *Limestones and Lime.*—7 samples of limestone and the same number of samples of lime were examined during the year, with the results shown in the table below. Of the limestones, Nos. 1 to 4 were sent by the Contractors, Prince's Dock, Nos. 5 and 6 by the Executive Engineer, Bombay, and No. 7 by the Engineer in charge Tánsa Water Works. Of the samples of lime, Nos. 8 and 9 sent by the Executive Engineer, Bombay, were obtained, respectively, from kunkurs Nos. 5 and 6; and Nos. 10 and 11 were samples of slaked lime sent by the Executive Engineer, Ahmedabad. Limes 12, 13, and 14 were sent by the Engineer in charge Tánsa Water Works. All three had been obtained from the same kunkur (No. 7), but No. 12 was the result of burning the kunkur with coal, while for Nos. 13 and 14 the fuel used was wood. No. 12, it will be noticed, yielded sulphuric acid ·33 per cent., equal to ·56 per cent. of sulphate of lime; No. 13, ·13 per cent., equal to sulphate of lime ·21 per cent.; and No. 14 was free from sulphuric acid. Sulphate of lime is known to augment the hydraulic qualities of mortar, and it is just possible that the superior hydraulic power believed to be possessed by coal-burnt, over wood-burnt lime, may be due to an augmentation of the amount of sulphate of lime resulting from oxidation of the sulphur of the coal:—

	Sand.	Silicic Acid.	Ferric Oxide and Alumina.	Carbonate of Magnesia.	Carbonate of Lime.
Limestones—					
1. Deorajpur No. 1	11·46	4·77	3·34	·99	79·94
2. Do. No. 2	13·01	6·16	3·98	·80	76·05
3. Surface kunkur No. 1	11·93	6·08	5·41	1·76	74·82
4. Do. No. 2	16·45	3·77	10·65	1·91	67·22
5. Andheri kunkur	13·61	3·18	4·02	Traces	79·19
6. Nuwápur do.	4·35	2·18	3·01	Do.	90·54
7. Kunkur from Tánsa	4·50	6·59	4·97	Do.	83·94

	Sand	Silica	Ferric Oxide and Alumina	Magnesia	Lime.	Water	Carbonic Acid.	Sulphuric Acid
Limes—								
8. From Andheri kunkur	12·94	9·86	8·15	Trace.	54·37	4·41	10·27	...
9. From Nuwápur do.	11·45	10·61	8·21	Do.	55·19	7·44	7·07	..
10. Bunwala (slaked lime)	5·21	5·58	4·32	1·40	78·58		4·91	..
11. Chapurkha do.	2·71	6·04	5·32	1·52	80·63		3·78	..
12. From kunkur No 7 (*a*)	14·45	11·68	·16	1·73	59·28		12·37	·33
13. Do. (*b*)	14·61	11·74	·28	2·16	57·85		13·33	·13
14. Do. (*c*)	14·62	10·98	·11	2·08	59·39		12·82	·00

61. *Alcoholic Liquids.*—The 19 examinations of liquids coming under this description included—(*a*) 5 samples of porter sent by the Medical Officer in charge Station Hospital, Deesa. These, it was suspected, had been diluted with water. 4 of the 5 ranged in original gravity from 1057·2 to 1058·5, and showed, therefore, no signs of dilution. The original gravity of the fifth sample—1049·0—was, however, suspiciously low. (*b*) A sample of bottled ale sent by the Officer Commanding at Colába, which it was suspected had been adulterated or drugged. No evidence of this, however, could be obtained on analysis. (*c*) 12 samples of country liquor forwarded for examination as to quality, &c., by various authorities. Of these 6 were sent by the Administrator, Rájpipla State, 2 by the Collector of Surat, one by the Collector of Thána, and one by the Assistant Surgeon in charge Bassein Dispensary; all these proved of fair quality. The remaining 2 samples were sent by Presidency Magistrates in Bombay with reference to cases of alleged breach, by liquor vendors, of the conditions of their licenses. (*d*) One sample of so-called Eau de Cologne sent by the Collector of Dhulia, which on examination turned out to be a slightly scented spirituous liquid 30·7 per cent. under proof. The bottle containing the sample was just under four ounces in capacity, and there could be little doubt but that the liquid, as was alleged, was entirely intended for use as a potable spirit.

62. *Milk and Ghee.*—4 samples of milk and 12 samples of ghee were examined during the year. The milk samples were all sent by the First Physician, Jamsetjee Jejeebhoy Hospital; all proved to be of good quality. Of the 12 samples of ghee 10 were samples of ghee sold by dealers in Bombay; of these 6 were found to be of good quality, 2 were of inferior quality, and 2 distinctly adulterated—one of them largely—with foreign fat. The other 2 samples were forwarded by the Cantonment Magistrate, Poona; both were found to be free from adulteration.

63. *Minerals, &c.*—The 14 substances classed under this head, examined during the year, comprised—(*a*) One sample each of orpiment gypsum and impure magnesium sulphate, also a sample of water highly charged with magnesium sulphate and containing a trace of mineral oil. All these were stated to have been found in the Grail District, Arabia. (*b*) 2 samples of sandstone quantitatively examined at the request of the contractors, Prince's Dock works. (*c*) A sample of supposed iron ore, which on examination was found to contain only 8·37 per cent. of iron as ferric oxide. (*d*) A sample of sand found at Bhatkal (Kánara) on a strip of beach about two furlongs in length; this was found to consist almost entirely of granules of quartz slightly coloured by oxide of iron. (*e*) A specimen of deposit found in the cylinders of a locomotive engine on the G. I. P. Railway, of which 41·5 per cent. was found to be finely divided carbon, indicating that the deposit was, at any rate, partly derived from smoke, and not wholly from the lubricants employed. (*f*) A sample of a deposit found inside a pulsometer at Itársi, on the G. I. P. Railway. This, on examination, proved to consist almost wholly of carbonate of lime, with which salt also the water of the well feeding the pulsometer was found to be highly charged; and (*g*) 3 samples of deposit sent by the Executive Engineer for Irrigation, Poona. These were stated to be left by water exuding from the rear face of a masonry dam. On examination the samples were ascertained to consist almost entirely of carbonate of lime, probably derived from the mortar binding the stones of the dam together.

64. *Sundry Substances.*—Of the remaining 26 samples of miscellaneous matters examined during the year, the following may be specially mentioned:—

(*a*) A letter cover sent by the Post Master General, Bombay, bearing 2 impressed stamps, viz. (1) a "too late" stamp and (2) the date stamp of the office of receipt. Examination of this cover showed, first, that it had been opened and again closed with gum after stamp (2) had been impressed upon it; and, second, that stamp (1) had been impressed upon the cover prior to stamp (2). (*b*) 2 pieces of scarlet serge sent by the Superintendent, Army Clothing Department. These were supposed to be affected by mildew, resulting from access of damp, owing to careless packing. On examination, however, the spots of supposed mildew turned out to be fat stains. (*c*) 4 packets of rupees and other matters sent by the Magistrate of Násik in a coin sweating case under investigation before him. One of the other matters submitted in this case was a box of thin crusts of silver, all bearing the impression of a rupee in relief on one side and in intaglio on the other. These crusts on the intaglio side had a thin layer of plumbago adherent to them. Similar very thin crusts were found adhering to some of the rupees. Many of the rupees were short in weight, the deficiency in some cases amounting to nearly 15 grains per rupee. From the appearance of the crusts it was pretty clear that they were electrotypes, very probably formed at the expense of the silver of the short weight rupees, and possibly intended to be used for covering discs of base metal. (*d*) One sample of a powder sent by the Commissioner of Police, Bombay, explosion of a quantity of which had resulted in 2 deaths. The powder, on analysis, proved to be a mixture of chlorate of potash and sulphur, a mixture liable on friction to explode with much violence.

65. *Sundry Substances—continued.*—Other matters coming under this head were—(*a*) 7 samples of articles of Indian manufacture sent for examination by various Government departments, with a view to their substitution for similar articles of foreign make. The samples, all of which proved to be of good quality, were one each of blue-black writing ink, bleaching powder, carbolic acid, arsenious oxide, nitric acid, hydrochloric acid, and sulphuric acid. (*b*) 2 samples of salt forwarded by one of the Magistrates of Thána District, one of which was suspected to be contraband. Analysis, however, showed it to be almost exactly of the same composition as the other sample, one of Government salt sent for comparison. (*c*) 3 samples of oil sent by the Agent, Southern Marátha Railway Company, all of which proved to be mixtures of cocoanut oil and petroleum; and (*d*) 3 samples of red lead sent for examination by merchants in Bombay, of which 2 proved to be largely adulterated with sand.

66. Up to the 13th May of the year under report the duties of the office of Chemical Analyser to Government were discharged by Surgeon-Major Lyon, and from that date to the close of the year by myself. During the whole year the office of Assistant Chemical Analyser to Government was held by the present incumbent, Assistant Surgeon M. G. Deshmukh, M.D., and I have great pleasure in bearing testimony to the great industry and ability displayed by that officer in the discharge of his onerous duties.

I have the honour to be,

Sir,

Your most obedient Servant,

A. MILNE, M.A., M.B., F.C.S., Surgeon,

Acting Chemical Analyser to Government.

Annual Reports: Report of the Chemical Analyser to Government for the year 1886.

No. 2436.

GENERAL DEPARTMENT.

Bombay Castle, 18th August 1887.

Letter from the Surgeon General with the Government of Bombay, No. s.n.—183, dated 20th May 1887—Submitting, with his remarks, the report of the Chemical Analyser to Government for the year 1886.

RESOLUTION.—During the year 1886 the Chemical Analyser investigated and reported on 296 medico-legal cases and examined 112 samples of potable water and 1,015 of Government stores and miscellaneous articles.

2. The decrease in medico-legal cases which in 1885 numbered 336 appears to have been mainly due to a more careful selection of the cases forwarded to the Chemical Analyser in which human poisoning was suspected, for in these cases, 159 in number as compared with 187 in 1885 the percentage of detections of poison was higher than usual. Arsenic was detected in 47, opium in 12, *dhatura* in 4 and other poisons in 26 cases. *Dhatura* caused no deaths, but of the 88 persons poisoned with arsenic 31 died, as also did all those (11 in number) poisoned with opium. In all 128 persons were poisoned of whom 50 died. The Chemical Analyser again states that in several instances little or no information was supplied to him regarding the nature of the criminal cases to which his analyses related. The attention of Police Superintendents should be again called to the subject, and the Chemical Analyser should in future write and ask for any further information he requires and report to the District Magistrates any cases in which the information supplied is obviously insufficient.

3. The remaining medico-legal cases comprised 83 of alleged cattle-poisoning and 54 in which articles suspected to be stained with blood or other animal fluids were forwarded for examination. Of the former cases poison was detected in 45 which included the poisoning of 55 animals. Arsenic was the poison usually employed, but no case was of special interest.

4. The information given in this report about samples of drinking water is detailed and instructive, and the attention of district officers should be drawn to Surgeon Milne's remarks as regards water sent from their respective districts. Of 112 samples examined 53 were classed as good. It is observed that all the samples taken from gurrahs and stand-pipes on railway platforms are favourably reported on.

5. 384 samples of Commissariat stores and 60 of Ordnance stores as well as 479 samples of various substances forwarded by the Customs and A'bkári Departments were examined. The latter included 322 samples of American petroleum all of which flashed above the legal minimum of 73° Abel. Statistics given by the Chemical Analyser show that the theory that petroleum is liable to undergo a depression of its flashing point during transit between America and India is not supported by his experiments. Of 9 other samples of petroleum which were examined one of naptha and one of benzine flashed much below the legal minimum. 92 articles classed as 'Miscellaneous' were also examined.

6. The report is as usual clear and concise, and bears testimony to the efficient way in which the heavy duties of Chemical Analyser were performed by Surgeon-Major Lyon and his *locum tenens* Surgeon Milne. The Governor in

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Council is glad to notice that Assistant Surgeon Deshmukh has again been commended for his work.

J. De C. ATKINS,
Under Secretary to Government.

To

The Surgeon General with the Government of Bombay,
The Sanitary Commissioner,
The Municipal Commissioner for the City of Bombay,
The Commissioner of Police, Bombay,
All District Superintendents of Police,
All Collectors, including the Collectors and Deputy Commissioners in Sind,
The Commissioner, N. D.,
The Commissioner, C. D.,
The Commissioner, S. D.,
The Commissioner in Sind,
The Commissioner of Customs, Salt, Opium and A'bkári,
The Revenue Department of the Secretariat,
The Judicial Department of the Secretariat,
The Political Department of the Secretariat,
The Military Department of the Secretariat,
The Compiler, General Administration Report for 1886-87.
} With copies of the report.

The Director of Agriculture,
The Editors' Table, Bombay,
The Branch Editors' Table, Poona, *care of* the City Magistrate, Poona,
The Editor, *Dhárwár Vritt* (for his own use and for the use of other Editors of Newspapers in Dhárwár),

The Secretary of State for India,
The Government of India,
} By letter.

No. of 1887.

Copy forwarded for information and guidance to